

Ambulation Level and Quality of Life in Transtibial Prosthesis Users: A Prosthesis Evaluation Questionnaire (PEQ) Analysis

Muhibbah Fatati, Dwi Setyawan

Health Polytechnic of the Ministry of Health Surakarta, Surakarta, Jawa Tengah, Indonesia

E-mail: muhibbahfatati2@gmail.com

ABSTRACT

Transtibial amputation is a type of lower extremity amputation that can cause limited mobility, decreased independence, and impaired quality of life. The use of a transtibial prosthesis aims to restore walking function (ambulation) so that individuals can return to performing daily activities independently. Good ambulation allows prosthesis users to participate more actively in social life, work, and physical activities, which can ultimately improve quality of life. The Prosthesis Evaluation Questionnaire (PEQ) measures the quality of life of prosthesis users. This instrument specifically assesses aspects of prosthesis function, ambulation, stump health, psychological well-being, and social aspects. The purpose of this study was to determine the relationship between the ambulation level and quality of life based on PEQ scores in transtibial prosthesis users. The research method was observational-analytic with a cross-sectional approach. The subjects were transtibial prosthesis users who met the inclusion criteria. Based on the statistical analysis, a p-value of 0.007 ($p < 0.05$) was obtained, indicating a significant relationship between ambulation level and quality of life in transtibial prosthesis users. The correlation coefficient of $r = 0.664$ indicates a strong and positive relationship between the two variables. This indicates that the higher the ambulation level in transtibial prosthesis users, the better their perceived quality of life.

Keywords: Transtibial prosthesis, ambulation, quality of life, Prosthesis Evaluation Questionnaire (PEQ), lower extremity amputation

INTRODUCTION

Lower extremity amputation is the loss of part or all of a lower limb, which can be caused by trauma, peripheral vascular disease, infection, or complications of diabetes mellitus. This condition impacts the physical aspects, affecting psychological and social aspects, and the individual's quality of life. One of the most common types of amputation is the transtibial amputation, a below-the-knee amputation that preserves the knee joint, thus providing biomechanical advantages in rehabilitation and prosthetic use (Setyawan & Fatati, 2025). Rehabilitation for transtibial amputees aims to restore functional ability, particularly ambulation, using prostheses. Prosthetic use allows individuals to resume walking and perform daily activities, thereby increasing independence (Nguyen et al., 2025). In transtibial prosthesis users, the ambulation level is often measured using the Medicare Functional Classification Level (K-Level). This instrument is used to assess the mobility of prosthesis users and to support rehabilitation planning and the selection of appropriate prosthesis components (Nataletti et al., 2026). The K-Level describes an individual's ability to walk, move around, overcome environmental obstacles, and perform certain physical activities. The higher the K-Level, the higher the ambulation ability and functional needs of the prosthesis user (Nataletti et al., 2026).

Quality of life in prosthesis users can be seen in the extent to which the transtibial prosthesis can restore body function, independence, and happiness to the user after limb loss. To assess quality of life specifically in prosthesis users, the Prosthesis Evaluation Questionnaire (PEQ) instrument is used, which covers the domains of ambulation, stump health, comfort, social function, and emotional well-being. The PEQ has proven good validity and reliability in assessing the experience of lower extremity prosthesis users. (Safer et al., 2015). Recent research shows that the ambulation domain in the PEQ has a positive correlation with the physical function and mobility abilities of prosthesis users, so that the better the ambulation ability, the better the patient's perceived quality of life. (Wurdeman et al., 2018).

A 2023–2024 study also showed that transtibial prosthesis users experienced variations in quality of life influenced by factors such as stump condition, prosthesis type, and individual functional ability, including the ambulation level achieved in daily activities. (Setyawan & Fatati, 2025). In addition, PEQ-based evaluations are also widely used in recent studies to comprehensively assess satisfaction, function, and quality of life in lower extremity prosthesis users. (Miyata et al., 2023)

However, the relationship between ambulation level and quality of life in transtibial prosthesis users still needs further study, especially using specific instruments such as the PEQ in various populations and clinical conditions. Various factors such as age, cause of amputation, duration of prosthesis use, and general health conditions can influence the results of this relationship. In relation to this presentation, the author will conduct a study on the relationship between ambulation level and quality of life based on the Prosthesis Evaluation Questionnaire (PEQ) in transtibial prosthesis users.

METHODS

Study Design

This type of research is quantitative, using an analytical observational design with a cross-sectional approach. This method studies the relationship between independent and dependent variables by simultaneously observing and measuring. This research design is appropriate for this research because it only observes and measures what is happening without providing any treatment to the respondents.

Population, Sample, and Sampling Technique

The population of this study was transtibial prosthesis users in Surakarta. The sample in this study was transtibial prosthesis users who met the inclusion and exclusion criteria. The sample selection used a purposive sampling technique. The sample of this study was transtibial prosthesis users who met the inclusion criteria, namely: undergoing transtibial amputation and having used a transtibial prosthesis, using a transtibial prosthesis for at least 3 months, aged 19-70 years, able to follow the instructions given in the questionnaire process, and willing to participate in this study. The exclusion criteria were that respondents were in pain and using bilateral prostheses. The independent variable in this study was the ambulation level, while the dependent variable was quality of life.

Instruments

The independent variable in the study was the ambulation level, a research instrument used to measure the ambulation level using the K-level. The K-level describes an individual's ability to walk, move around, overcome environmental obstacles, and perform certain physical activities. The higher the K-level, the higher the ambulation ability and functional needs of the prosthesis user (Nataletti et al., 2026). In this study, the ambulation rate was obtained from secondary data.

The dependent variable in this study was quality of life. The research instrument used to measure quality of life was the Prosthesis Evaluation Questionnaire (PEQ). The PEQ is a

specific instrument developed to assess quality of life related to prosthesis use in individuals with lower limb amputations. This instrument covers aspects of prosthesis function, mobility, residual limb health, social burden, psychological well-being, and user satisfaction with the prosthesis. Recent research has shown that the PEQ remains a valid, reliable, and widely used instrument to evaluate the quality of life of lower limb prosthesis users in both research and clinical practice (Maronati et al., 2024). PEQ is still recommended in the latest research and clinical evaluations because it can comprehensively assess the impact of prosthesis use from physical, functional, psychological and social aspects. The latest validation of the Thai version in 2024 also shows that the PEQ remains a valid and reliable instrument for measuring the quality of life of lower extremity prosthesis users (Dajpratham et al., 2026).

This study used the Shapiro-Wilk normality test because the sample size was less than 50 people. If the data were normally distributed, parametric statistics were used. If the data were not normally distributed, non-parametric statistics were used. If the output of this normality test was $p > 0.05$, the input data were normally distributed.

After the normality test, the hypothesis was tested using correlation analysis. If the data were normally distributed, the Pearson product-moment correlation technique was used. If the data were not normal, the Spearman rank technique was used. If the $p\text{-value} < 0.05$, H_0 is rejected and H_a is accepted. If the $p\text{-value} > 0.05$, H_0 is accepted and H_a is rejected.

Ethical Considerations

This study received ethical approval from the Research Ethics Committee of 'Aisyiyah University Surakarta with No. 0144/VI/AUEC/2026. All respondents were informed about the objectives, procedures, benefits, and risks of the study, and signed an informed consent form before participating in the study.

RESULTS

1. Overview

The study, entitled "The Relationship Between Ambulation Level and Quality of Life in Transtibial Prosthesis Users," was conducted at the IPUD Prosthetic Leg Clinic in Soloraya. The study was conducted from March to November 2024" to "Clinical data collection was conducted from March to November 2024, with final data compilation and analysis completed in mid-2026. The subjects were 15 transtibial prosthesis users. This study aimed to determine the relationship between ambulation level and quality of life in transtibial prosthesis users based on the Prosthesis Evaluation Questionnaire (PEQ).

Table 1 Demographic Characteristics of Respondents, June 2026 (n=15)

Characteristics	n	%
Gender		
Male	12	80
Female	3	20
Age		
21 – 30	1	7
31 – 40	4	27
41 – 50	6	40
51 – 60	2	13
61 – 70	2	13
Body Mass Index		
17.0 – 18.4	0	0
18.5 – 25.0	7	46.7
25.1 – 27.0	6	40
> 27	2	13.3
Causes of Amputation		
Accidents	11	73.3
Diabetes mellitus	4	26.7

Based on Table 1, it shows that the youngest age is 26, while the oldest is 61. Meanwhile, the lowest body mass index is 20.76 and the highest is 32.87. The average respondent is male.

Table 2. Subject Characteristics Based on Quality of Life

Quality of Life	Frequency	Presentation (%)
Grades 1-2	0	0
Grade 3-4	0	0
Grade 5-6	3	20
Grade 7-8	7	47
Grade 9-10	5	33
Total	15	100

Based on Table 2, it shows that the transtibial prosthesis users with the highest quality of life are those with a quality score of 7-8, amounting to 7 people (47%).

Table 3. Subject Characteristics Based on Ambulation Level

Ambulation Level	Frequency	Presentation (%)
K2	5	33.3
K3	10	66.7
Total	15	100

Table 3 shows that transtibial prosthesis users with the highest ambulation level are in the K3 category, at 66.7%. K3 is interpreted as an individual having the ability or potential to walk at variable speeds (variable cadence) and being able to overcome most environmental obstacles. K3 users are generally active at work and engage in light exercise. In many studies of active transtibial prosthesis users, the majority of subjects are in the K3 category.

2. Data Analysis

a. Data Normality

In this study, the sample consisted of 15 people, so the normality test used was the Shapiro-Wilk test.

Table 4 Shapiro-Wilk Test Results

Variable	<i>p value</i>	α	Information
Ambulation level	0.001	0.05	Abnormal
Quality of life	0.157		Normal

The results of the data normality test using the Shapiro-Wilk test have p-values of 0.001 and 0.157 for the ambulation level and quality of life variables, so it can be interpreted that there are variables whose data are not normally distributed, the Spearman correlation test is used.

b. Hypothesis Testing

Hypothesis testing was conducted to determine whether there was a relationship between ambulation level and quality of life in transtibial prosthesis users. Based on the results of the normality test, which showed abnormality, the Spearman rank test was used.

Table 5. Results of Spearman rank

Variable	Correlation coefficient	p value	Information
Ambulation level Quality of life	0.664	0.007	relate

The results of the hypothesis test obtained a significance result of 0.007. From these results, it can be seen that there is a significant correlation between the two variables that are connected because the value is <0.05 . The correlation coefficient between the ambulation level and quality of life is 0.664, which means there is a strong relationship between the variables.

DISCUSSION

The study entitled "The Relationship Between Ambulation Level and Quality of Life Based on the Prosthesis Evaluation Questionnaire (PEQ) in Transtibial Prosthesis Users" found that in the measurement of level 2 (K2), the ambulation level was 5 people or 33.3%, while the measurement of level 3 (K3) ambulation level was 10 people or 66.7%. Measurement of quality of life using the Prosthesis Evaluation Questionnaire (PEQ) showed that there were 3 respondents with a quality of life value of 6, 2 respondents with a quality of life value of 7, 3 respondents with a quality of life value of 8, 3 respondents with a quality of life value of 9, and 3 respondents with a quality of life value of 10. This shows that transtibial prosthesis users with the highest ambulation level in the K3 category were 66.7%, while the average quality of life was at a value of 8.14. The higher a person's ambulation level, the better their ability to carry out daily activities, participate in social activities, work, and play roles in society. This condition can increase independence, self-confidence, and overall life satisfaction.

The results of the analysis test showed a p-value of 0.007, so it can be concluded that there is a significant correlation between the ambulation level variable and quality of life. The correlation coefficient between the ambulation level and quality of life is 0.664, which can be interpreted as indicating that the two variables have a strong relationship with a positive correlation direction; the higher the ambulation level of transtibial prosthesis users, the better the individual's ability to perform activities, which can increase self-confidence, reduce dependence on others, and improve perceptions of overall quality of life.

This study aligns with research conducted on 509 patients using lower limb prostheses, which found that mobility was positively correlated with quality of life, with a p-value of 0.001 and an r-value of 0.511. This suggests that mobility is related to quality of life (Wurdeman et al., 2018). There are two types of quality-of-life indicators, namely subjective and objective indicators. Objective indicators can be in the form of income as a reference, while subjective indicators, such as happiness, are a personal assessment. (Kiling & Kiling-Bunga, 2019).

The average quality of life score for transtibial users with ambulation level 2 (K2) in this study was 7.248, while for those with ambulation level 3 (K3) it was 8.590. These findings indicate that respondents with higher ambulation ability have a better quality of life than those with lower ambulation ability. Improved walking ability allows individuals to perform daily activities more independently, increase social participation, maintain productive activities, and improve physical and psychological well-being, which ultimately has a positive impact on quality of life. (DadeMatthews et al., 2024).

The results of this study are consistent with a 2018 study on mobility and quality of life. The study showed a significant positive relationship between mobility and quality of life in lower extremity prosthesis users ($r = 0.511$; $p < 0.001$). These findings suggest that increased mobility can contribute to improved quality of life and satisfaction levels among prosthesis users. (Wurdeman et al., 2018).

LIMITATIONS OF THE STUDY

Despite these promising findings, this study acknowledges certain limitations. The relatively small sample size ($n=15$) and the single-center cross-sectional design restrict the broad generalizability of our results. Furthermore, as a cross-sectional study, causal inferences cannot be definitively established. Future multi-center longitudinal studies with larger cohorts are warranted to validate these findings and explore the long-term trajectories of quality of life following prosthetic interventions

CONCLUSION

Based on the statistical analysis, a p -value of 0.007 ($p < 0.05$) was obtained, indicating a significant relationship between the ambulation level and quality of life in transtibial prosthesis users. The correlation coefficient value of $r = 0.664$ indicates that the relationship between the two variables is strong and has a positive direction. This indicates that the higher the ambulation level of transtibial prosthesis users, the better their perceived quality of life.

ACKNOWLEDGEMENTS

Thank you to all parties who have supported this research.

CONFLICT OF INTEREST

There is no conflict of interest in this research.

RESEARCH FUNDING

There was no funding support for this research.

REFERENCES

- DadeMatthews, O. O., Roper, J. A., Vazquez, A., Shannon, D. M., & Sefton, J. M. (2024). Prosthetic device and service satisfaction, quality of life, and functional performance in lower limb prosthesis clients. *Prosthetics & Orthotics International*, 48(4), 422–430. <https://doi.org/10.1097/PXR.0000000000000285>
- Dajpratham, P., Anyapho, W., Muangpaisan, W., Pattaravoratham, S., & Amattayakul, M. (2026). Validation and reliability of the prosthesis evaluation questionnaire–Thai version for lower-limb amputees. *Prosthetics & Orthotics International*, 50(3), 283–289. <https://doi.org/10.1097/PXR.0000000000000502>
- Kiling, I. Y., & Kiling-Bunga, B. N. (2019). Pengukuran dan Faktor Kualitas Hidup pada Orang Usia Lanjut. *Journal of Health and Behavioral Science*, 1(3), 149–165. <https://doi.org/10.35508/jhbs.v1i3.2095>
- Kurtaran, M., ÇELİK, D., & YELDAN, İ. (2022). Farklı Fonksiyone Mobilite Düzeyine Sahip Transtibial Amputelerde Proteze Uyum, Vücut İmajı Ve Yaş Kalitesinin Karşılaştırılması. *Gazi Sağlık Bilimleri Dergisi*, 7(3), 62–73. <https://doi.org/10.52881/gsbdergi.1172645>
- Maronati, R., Rigot, S. K., Mummidisetty, C. K., Jayaraman, C., Hoppe-Ludwig, S., & Jayaraman, A. (2024). Evaluating the Usability and Equivalence of Electronic Patient-Reported Outcome Measures for Individuals with a Lower-Limb Amputation. *JPO Journal of Prosthetics and Orthotics*, 36(3), 205–213. <https://doi.org/10.1097/JPO.0000000000000476>
- Miyata, Y., Sasaki, K., Guerra, G., Dacharux, W., & Chaiwan, P. (2023). Evaluating Feasibility and Durability of the Aero Prosthetic Liner in Transtibial Prosthetic Users. *Canadian Prosthetics and Orthotics Journal*, 6(1). <https://doi.org/10.33137/cpoj.v6i1.41865>
- Nataletti, S., Okita, S., Sindorf, J., O'Brien, M. K., Maronati, R., McGuire, M., Hoppe-Ludwig, S., Banerjee, A., Wacek, A., Cave, J., Looft, J. M., Hendershot, B. D., & Jayaraman, A. (2026). Predicting prosthesis use and mobility needs in lower limb amputees: a machine learning approach using clinical and actigraphy data. *Journal of NeuroEngineering and Rehabilitation*, 23(1), 165. <https://doi.org/10.1186/s12984-026-01954-3>
- Nguyen, T. T., Wang, B., Alas, H., Jones, Q., Clark, C., Lazar, S., Malik, S., Graham, J., Talaat, Y., Shin, C., Schofield, J., Macleod, T., Smedley, L., Pereira, C., Joiner, W., Randall, R. L., Farmer, D., Wang, A., Hao, D., ... Li, A. (2025). Prosthesis Embodiment in Lower Extremity Limb Loss: A Narrative Review. *Applied Sciences (Switzerland)*, 15(9). <https://doi.org/10.3390/app15094952>
- Safer, V. B., Yavuzer, G., Demir, S. O., Yanikoglu, I., & Guneri, F. D. (2015). The prosthesis evaluation questionnaire: Reliability and cross-validation of the Turkish version. *Journal of Physical Therapy Science*, 27(6), 1677–1680. <https://doi.org/10.1589/jpts.27.1677>
- Setyawan, D., & Fatati, M. (2025). Quality of Life Among Diabetic Patients Using Transtibial Prostheses: A Descriptive Study. *Gaster*, 23(2), 188–197. <https://doi.org/10.30787/gaster.v23i2.1915>
- Wurdeman, S. R., Stevens, P. M., & Campbell, J. H. (2018). Mobility Analysis of Amputees (MAAT I): Quality of life and satisfaction are strongly related to mobility for patients with a lower limb prosthesis. *Prosthetics and Orthotics International*, 42(5), 498–503. <https://doi.org/10.1177/0309364617736089>